

## Role of Ultrasound Guided Core Needle Biopsy in Diagnosis of Pediatric Renal and suprarenal Tumors

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### ABSTRACT:

#### BACKGROUND:

Core Needle Biopsy involves introducing large hollow needle through the skin to collect a tissue for investigation. It's become a well-established method as the standard sampling procedure. It's a relatively safe, minimal invasive procedure with diagnostic accuracy comparable to open surgical biopsy.

#### AIM OF STUDY:

Assess the accuracy and safety of core needle biopsy in diagnosis of renal and suprarenal tumors.

#### METHODS:

This is a prospective interventional study. Core needle biopsy was done for 42 patients; 38 patients were included. Biopsy done by activation of needle biopsy device that introduced into the tumor under ultrasound guidance and collection of sample.

#### RESULTS:

Wilms tumor was positive in 71.1 % (n=27), 23.6 % (n=9) were neuroblastoma and 5.3 % (n=2) were non-conclusive. Only 18.4% (n=7) developed hematuria while intra-abdominal bleeding was not observed in any patient. For Wilms tumor the sensitivity is 93.1 % and the specificity is 100 % and diagnostic accuracy is 94.7 %. The sensitivity, specificity and diagnostic accuracy for neuroblastoma are 100 %.

#### CONCLUSION:

It is a simple, safe and efficient method for diagnosing renal and suprarenal tumors, complications occur infrequent, and most are easily treated or self-limiting.

**KEYWORDS:** Core biopsy, diagnosis, renal tumors.

### INTRODUCTION:

Core needle biopsy is a procedure involving insertion of a large hollow needle through the skin to collect and remove a tissue for analysis.<sup>(1, 2)</sup>

The needle biopsy technique was introduced in 1951, and was generally employed after further development in 1954.<sup>(3)</sup>

Various guidance methods of core biopsy may be used like fluoroscope, ultrasound, CT and MRI.<sup>(4)</sup>

Currently, Ultrasound guided core biopsy (USCB) is well established in many medical fields as the standard tissue sampling procedure.<sup>(5)</sup>

A systematic review proves the role of USCB in pediatric tumors, which was associated with a high biopsy adequacy rate (94 %), and low complication rate (1%).<sup>(6)</sup>

A biopsy needle comprises of an inner stylet/trocar and outer sheath. The inner stylet is where the tissue sample is collected.

#### Biopsy needle Principle and technique

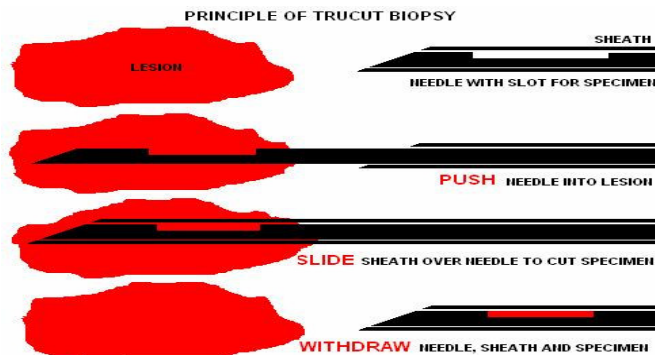
Manual device: The inner stylet/ trocar is advanced into the tissue manually by the operator.

Automated device: The inner stylet/trocar and outer sheath advance following release of a spring-loaded firing mechanism. This device can be operated with one hand.

Biopsy Gun: A reusable spring-loaded biopsy device which can use a variety of single-use biopsy needles of different sizes.

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**Figure 1: Principle of Core needle biopsy** <sup>(7)</sup>

Various core needle devices may be used. These typically range in size from 14 to 18 gauge. Success with core needle biopsy has been demonstrated in a wide variety of anatomic locations. These procedures may be performed under either sedation or general anesthesia with controlled ventilation. Advantage of core needle biopsy versus fine-needle aspiration is that it provides a sample sufficient in size to allow histologic examination rather than only cytologic examination. In addition, it can provide sufficient tissue for molecular evaluation.<sup>(8)</sup>

Core-needle biopsy often allows patients to avoid surgical biopsy, a more invasive, time-consuming, costly, and anxiety-provoking procedure. Surgical biopsy is also technically more difficult, has increased risk of complications and increased recovery time and is more likely to have an unsatisfactory cosmetic result.<sup>(9)</sup>

#### **Renal tumors**

Nearly 6–7% of pediatric cancers consist of renal tumors, and 90% of them are Wilms tumors (WT).<sup>(10)</sup>

Adjacent to kidney: neuroblastoma which is not a tumor of the kidney, but of the adrenal and other neural crest tissues, it needs to be differentiated from a Wilms tumor.<sup>(11)</sup>

There is evidence that preoperative imaging for differentiation between Wilms tumors and Non-Wilms tumors is not in 100% accurate. A specific diagnostic challenge is the differentiation between neuroblastoma and Wilms tumor.<sup>(12)</sup>

#### **Mistaking Xanthogranulomatous pyelonephritis for Wilms tumor**

Xanthogranulomatous pyelonephritis (XGP) is a severe, atypical variant of chronic pyelonephritis and is rare in children. XGP is characterized by the destruction of renal parenchyma and replacement by granulomatous

tissue containing lipid-laden macrophages. On US Typically, a solid mass is present showing areas of cystic necrosis. Abnormal tissue may breach the renal capsule and is frequently mistaken for a Wilms' tumor.<sup>(13)</sup>

#### **AIM OF STUDY:**

The aim of this study is to assess the accuracy and safety of core needle biopsy in diagnosis of renal and suprarenal tumors.

#### **PATIENTS AND METHODS:**

This is a prospective interventional study done at pediatric surgical department, Children Welfare Teaching Hospital, Baghdad medical city. It was conducted from January 2017 to December 2018. A Core needle biopsy was done (or Core needle biopsies were done) for a total number of 42 patients with renal masses during the entire study period, 38 patients were included in this study and four patients were excluded due to inadequate data. The histopathology result of core biopsy needle was compared with result of excisional biopsy to determine if the core needle biopsy accurately detecting final pathology.

Data collecting sheet filled with name, age, gender, address, ultrasound finding, date of procedure, type of sedation, size of cutting needle, number of passes, developing of short term complications (hematuria and/or bleeding) were documented for all patients. History taken and general physical examination with an abdominal examination were done for all patients.

Written informed consent was obtained from the patient's family before the procedure.

Investigations done (patient sent by oncologist before referral) including complete blood count, blood urea level, serum creatinine level, prothrombin time, partial thromboplastin time and abdominal ultrasonography ± CT scan of the abdomen.

**Inclusion criteria:** Any patient with renal or suprarenal mass in clinical and Radiological examination referred from oncology consultation clinic.

**Method of Biopsy:** After insertion of intravenous cannula, patients sedated and local anesthetic cream is applied. At the time of biopsy, in the US room, and on the table, patient was lying in supine position. The mass was evaluated using new conventional and Color Doppler ultrasound. The skin overlying the mass is prepared and draped, Sterile surgical gloves were worn. The activated biopsy needle (Automated spring-loaded core biopsy needle) was introduced through the skin into the tumor under ultrasound guidance and firing the spring. Careful inspection of the biopsy was done and then put inside a formaldehyde filled pot. All the procedures were done under a complete aseptic technique. Ultrasonography was done after about 30 minutes after the procedure to exclude bleeding. Sample Biopsy was sent to histopathological study. Oral paracetamol was advised to use for post procedure analgesia.

**RESULTS:**

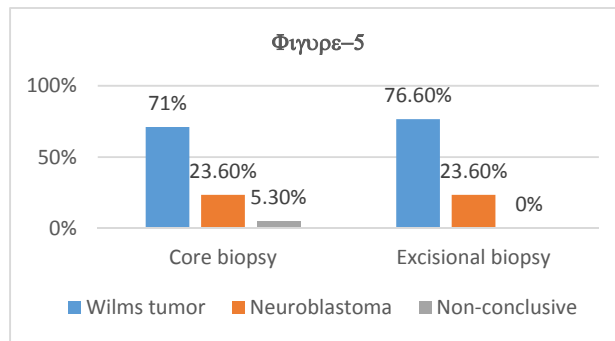
The mean age was  $39 \pm 29$  SD months. The male patients were 42.1 % (n=16) and the females were 57.9 % (n=22). Wilms tumor was positive by Core needle biopsy in 71.1 % (n=27), 23.6 % (n=9) were neuroblastoma and 5.3 % (n=2) were non-conclusive by histopathologic examination. **(Figure-2)**

According to age; patients were divided into three groups, the first group (< 1 year), the second group (1-5 years) and the third group (5-14 years). **(Table-1)**

Only 18.4% (n=7) developed hematuria after the procedure while intra-abdominal bleeding was not observed in any patient.

The sensitivity of Core needle biopsy in diagnosis of Wilms tumor is 93.1 % and the specificity is 100 % and diagnostic accuracy is 94.7 %. **(Table-2)**

The sensitivity, specificity and diagnostic accuracy of Core needle biopsy in diagnosis of neuroblastoma are 100 %. **(Table-3)**



**Figure 2: Percentages of renal tumors diagnosed by Core needle biopsy and excisional biopsy.**

**Table 1: Distribution of Core needle biopsy patients according to age groups.**

Age group	Wilms tumor	Neuroblastoma	Non-conclusive	Total No.
< year	2	4	1	7
1-5 years	19	5	1	25
5-14 years	6	0	0	6
Total	27	9	2	38

**Table 2: Sensitivity and specificity of core needle biopsy in the diagnosis of Wilms tumor.**

Wilms tumor	Disease positive	Disease negative	
Positive Test	27	0	PPV 100 %
Negative Test	2	9	NPV 81.8 %
	Sensitivity 93.1 %	Specificity 100 %	DA 94.7 %

**Table 3: Sensitivity and specificity of core needle biopsy in the diagnosis of neuroblastoma.**

Neuroblastoma	Disease positive	Disease negative	
Positive Test	9	0	PPV 100 %
Negative Test	0	29	NPV 100 %
	Sensitivity 100%	Specificity 100 %	DA 100 %

**DISCUSSION:**

Histopathological diagnosis is critically important before the treatment of pediatric renal tumors. Several studies have shown that by percutaneous cutting needle biopsies representative tumor samples can be obtained and reliable diagnoses of renal tumors established.<sup>(14)</sup>

In this study, a Core needle biopsy was (or Core needle biopsies were) done for 38 patients with renal tumors. The present study shows that the male patients were 42.1 % (n=16) and the females were 57.9 % (n=22), these findings are slightly less than the results of Dykes et al in 1991<sup>(15)</sup>, in which male patients were 47% and female patients were 53%, which is may be due to small sample size in the present study.

The current study found that Wilms tumor was positive by Core needle biopsy in 71.1 % (n=27) patients, which is lower than the results found in Kurian et al in 2018<sup>(16)</sup> (80.2) %, Vujanic’ et al in 2003<sup>(17)</sup> (85%), Dykes et al in 1991 (83%) and Cost et al in 2013<sup>(18)</sup> (77.7%). However, these studies used core needle biopsy only for the evaluation of suspected Wilms tumor, while in this study all renal masses are evaluated by core needle biopsy. Thus, the disadvantage of depending on the imaging only in the diagnosis can result in both under-treatment or even overtreatment.

In this study, we found that 5.3 % (n=2) of core needle biopsies were non-conclusive by histopathologic examination, that approximate the results of Vujanic’ et al in 2003 was 4%, and Kurian et al at 2018 was 5.4% and lower than the results of Dykes et al (1991) (8.3%).

This May be occurring due to the use of older types of core biopsy needles in Dykes et al (1991) than that used in the current study.

In term of safety of percutaneous core needle biopsy, this study shows that short term complication was noticed only in 18.4% (n=7) who developed hematuria after the procedure while intra-abdominal bleeding was not observed in any patient by ultrasonic examination following the procedure. In Vujanic’ et al in 2003, one child needed emergency nephrectomy because of considerable intra-tumoral bleeding, another patient had tumor rupture and subsequently died.

These differences may be due to the smaller size of sample in this study compared to Vujanic’ et al in 2003 (241 biopsies), also Ultrasound done before the biopsy guaranteed that the passes would be made only through the solid areas of the mass, thus avoiding tumor rupture/bleeding.

The current study shows that the sensitivity of Core needle biopsy in diagnosis of Wilms tumor is 93.1 %, the specificity is 100 % and the diagnostic accuracy is 94.7% Which is slightly less than results of Kurian et al at 2018 that found the sensitivity was 98.4%, but higher than results found in Garrett et al in 2005<sup>(19)</sup> that found the sensitivity regarding diagnosis of Wilms tumor was 85.7 % and specificity was 100 % ;however, Garrett et al in 2005 had used different modality of guidance of core biopsy needle (fluoroscope, ultrasound and CT scan) and have larger sample size (202), while in this study, only Ultrasound was used for core biopsy guidance in a total of 38 patients only.

In the present work, the sensitivity, specificity and diagnostic accuracy of Core needle biopsy in diagnosis of neuroblastoma tumor is 100 %, Which is higher than results of Garrett et al in 2005 that found the sensitivity was 92.3 % and the specificity was 100 %. The lower sensitivity in above mentioned study is probably attributed to larger sample size compared to the present study.

**CONCLUSION:**

Ultrasound-guided core-needle biopsy is a simple, safe and efficient, highly sensitive and specific method for diagnosing renal and suprarenal tumors, short term complications occur infrequent, and most are easily treated or self-limiting and lastly core needle biopsy have high diagnostic accuracy.

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